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IS : 9589 - 1980

Indian Standard

(Reaffirmed 2002)

**SPECIFICATION FOR
ELECTRIC LAMPS FOR RAILWAY SIGNALLING**

(First Reprint MAY 1997)

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

*Indian Standard*SPECIFICATION FOR
ELECTRIC LAMPS FOR RAILWAY SIGNALLING

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SPECIFICATION FOR ELECTRIC LAMPS FOR RAILWAY SIGNALLING

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 21 August 1980, after the draft finalized by the Electric Lamps and Accessories Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 In modern railway signalling, colour light signals are used for guiding the movements of the trains. The colour light signal is an efficient optical system comprising an electric signal lamp and combination of lenses and filters so that it is capable of giving long range visibility for indication during day as well as night. Lamps used for signalling should be able to withstand shocks and vibrations to which they are subjected when mounted in the signals.

0.3 In addition to the lamps mentioned in this standard, the following lamps are also used in railway signalling which are covered by the Indian Standard specifications indicated against them:

<i>Description</i>	<i>Specification</i>	<i>Use</i>
12 V, 1.2 W	IS : 1901-1978* }	Illuminated diagrams and control panels
24 V, 2.4 W	do }	
110 V, 25 W	IS : 418-1978†	Position light and shunt signals

0.4 In the preparation of this standard assistance has been derived from BS : 469 : 1960 'Specification for electric lamps for railway signalling', issued by the British Standards Institution.

0.5 The designation and dimensions of the caps to be fitted to the lamps are the same as those recommended in the IEC Publication 61-1 (1969) 'Lamp caps and holders together with gauges for the control of interchangeability and safety : Part I Lamp caps', published by the International Electrotechnical Commission.

*Specification for visual indicator lamps (*first revision*).

†Specification for tungsten filament general service electric lamps (*third revision*).

0.6 Due to lack of sufficient data regarding the actual parameters of shocks and vibrations encountered during the service by the lamps no standard method or requirements for vibration test on railway signalling lamps have been included in the standard. This subject is being actively studied and it is hoped that at a later stage it would be possible to include the requirements and method of test for vibration also in the standard.

0.7 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard specifies the technical requirements for the railway signalling lamps given in Table 1 and the methods of test to be used for determining their quality and interchangeability.

TABLE 1 RANGE OF LAMPS COVERED

REFERENCE No.	USE
(1)	(2)
SL 5	Repeaters and indicators, Multi-lamp route indicators with parallel connection
SL 13	Multi-lamp route indicators with series connection
SL 16	Searchlight signals
SL 17 }	Multiple aspect colour light signals Direction type route indicators
SL 18 }	
SL 21 }	
SL 33	Direction type route indicators
SL 35	Multiple aspect colour light signals

NOTE — The lamps are designated by the reference numbers set out in the table which also gives their usual application. The letters 'SL' signify 'Signalling Lamps'.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Rated Voltage — The voltage marked on the lamp.

2.2 Rated Wattage — The wattage marked on the lamp.

2.3 Double Pole — Denotes in a double-filament lamp that both filaments are connected permanently in parallel.

*Rules for rounding off numerical values (*revised*).

2.4 Triple Pole — Denotes in a double-filament lamp that one end of each filament is connected to the cap shell and the other ends of the filaments are connected one to each contact plate.

2.5 Light Centre — The geometric centre of the filament (the main filament of double filament lamps) or, in case of bow filaments, the centre of the enclosing rectangle.

2.6 Light Centre Length — The perpendicular distance of the light centre from the plane which is normal to the cap axis and lies along the surface of the pins at the point nearest to the filament.

2.7 Axil Error (for Lamps Other Than Those with Offset Filaments) — The perpendicular distance of the light centre from the axis of the cap.

2.8 Lumen — The unit of luminous flux. It is equal to the flux emitted in a solid angle of one steradian by a uniform point source having an intensity of one candela.

NOTE — Candela is a unit of luminous intensity. It is of a magnitude such that the luminance of a full radiator at the temperature of solidification of platinum is 60 units of luminous intensity per square centimetre.

2.9 Initial Readings — The photometric and electrical measurements made at the end of the ageing period.

2.10 Lumen Maintenance — The ratio of the luminous flux of an individual lamp at the specified time of measurement during the life test to that measured in the initial readings test expressed as a percentage.

2.11 Life of a Lamp — Life of a lamp is the number of hours it operates to burn-out or to any other criterion of life performance laid down in this standard.

2.12 Ageing — The burning of a new lamp for a specified period.

2.13 Batch — All the lamps of the same reference number put forward at one time for test for acceptance.

2.14 Test Quantities

2.14.1 Inspection Test Quantity (ITQ) — The number of lamps to be tested with the object of determining the acceptability of the batch as to the marking, mechanical and physical requirements.

2.14.2 Rating Test Quantity (RTQ) — The number of lamps to be tested with the object of determining the acceptability of the batch as to initial readings.

2.14.3 Life Test Quantity (LTQ) — The number of lamps to be tested with the object of determining the acceptability of the batch as to life.

3. REQUIREMENTS

3.1 Mechanical and Physical Requirements

3.1.1 Bulbs — The bulbs shall be clear, uniform and free from defects detrimental to service and shall comply with the requirements laid down in IS : 1112-1963*. The bulbs shall be symmetrically attached to the caps.

3.1.2 Caps — The bayonet caps shall be of brass or aluminium and of dimensions given in Appendix A, Table 6. The caps shall be so constructed and attached to the bulbs as to comply with the torsion test mentioned in 6.2.2.

3.1.3 Insulation Resistance — Except in triple pole lamps, the insulation resistance between the contact plates and the shell of the cap when measured in accordance with 6.2.3 shall not be less than 50 megohms in the case of B22 (3-pin) caps and 10 megohms in the case of B15 caps.

3.1.4 Aging — Before the insulation resistance test and the initial readings are taken, the lamps shall be aged at the rated voltage of the main filament for 1 hour. A lamp found to be inoperative when inspected at the end of this period shall be deemed to have failed to satisfy the requirement of this clause.

3.1.5 Dimensions of Lamps — Dimensions of lamps shall be in accordance with Table 2 and Fig. 1 to 4.

3.1.6 Solder — The solder shall be so applied as not to interfere with the proper engagement of the cap with the lamp holder. The contact plates shall be evenly soldered to ensure satisfactory electrical contact in the appropriate lamp holder. The solder shall have a softening point in excess of 290°C.

NOTE — It is not essential that the whole surface of the eyelet should be covered with solder, provided there is good electrical contact between the lead-in wire and the eyelet, and the projecting portion of the wire above the solder, if any, should not be more than 1 mm.

3.2 Initial Readings

3.2.1 Initial readings shall comply with the values specified in Table 3.

*Specification for glass shells for general lighting service lamps (revised).

TABLE 2 DIMENSIONS

(Clauses 3.1.5 and 6.1.1)

REFER- ENCE NUM- BER	FILAMENT RATING				CAP	FILA- MENT ARRAN- GEMENT	FIG. No.	OVERALL DIMENSIONS		LIGHT CENTRE LENGTH	MAX AXIAL ERROR	OPERATING POSITION
	Main		Auxiliary					Length	Diameter			
	Volts	Watt	Volts	Watt								
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
								mm	mm	mm	mm	
SL 5	12	4	—	—	BA 15d*	—	—	32.5 ± 2.5	18 ± 1	—	—	Horizontal do do
SL 13	6	12	—	—		—	1	56 ± 4	38 ± 2	32 ± 0.5	0.5	
SL 16	12	12	—	—		—	1	56 ± 4	38 ± 2	32 ± 0.5	0.5	
SL 17†	12	16	16	12	B22/25 × 26 (3-pin)	Double pole	2	83 <i>Max</i>	52 <i>Max</i> 43 <i>Min</i>	42 ± 0.5	—	Vertical cap down do do
SL 18†	12	24	—	—		—	3	83 <i>Max</i>	52 <i>Max</i> 43 <i>Min</i>	42 ± 0.5	—	
SL 21†	12	24	16	12		Double pole	2	83 <i>Max</i>	52 <i>Max</i> 43 <i>Min</i>	42 ± 0.5	—	
SL 33	110	25	—	—	B22/25 × 26 (3-pin or 2-pin)	—	4	83 <i>Max</i>	52 <i>Max</i> 43 <i>Min</i>	42 ± 0.5	—	do
SL 35†	12	24	12	24	B22/25 × 26 (3-pin)	Triple pole	2	83 <i>Max</i>	52 <i>Max</i> 43 <i>Min</i>	42 ± 0.5	—	do

*BA 15s caps can be supplied in place of BA 15d caps, on demand, for single filament lamps.

†The light-centres of the filaments shall be not more than 0.5 mm from the plane containing the axis of the cap and the rear pin (see Fig. 2 and 3). No part of the auxiliary filament shall lie beyond 1 mm off the axis of the cap.

3.3 Life Test — Life and Lumen Maintenance

3.3.1 The life of test bulb when tested in accordance with 7.4 shall comply with the values for specified life given in Table 3.

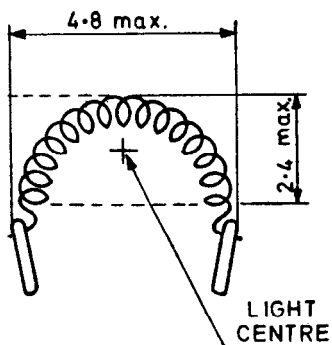
3.3.2 The lumens of each lamp shall be measured at 75 ± 2.5 percent of specified life. The lumen maintenance shall not be less than 85 percent except in case of SL 33 lamps for which the limit shall be 78 percent.

4. SAMPLING

4.1 Samples for testing shall be selected from lamps belonging to one batch (*see also* Appendix B).

4.1.1 *Batch Consisting of 1 000 Lamps or Less* — For batches consisting of 10 or less containers, lamps shall be selected from every container. For batches consisting of more than 10 containers, lamps shall be selected from at least one half of the total number of containers in the batch with a minimum of 10 containers.

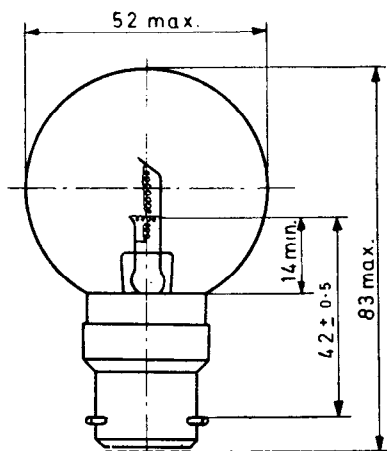
4.1.2 *Batch Consisting of More Than 1 000 Lamps* — The lamps shall be selected as far as possible from one third of the total number of containers in the batch with a minimum of 10 containers.



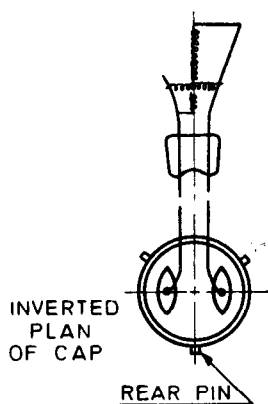
For lamps SL 13 and 16 the plane containing the filament shall be normal to the axis of the cap pin.

All dimensions in millimetres.

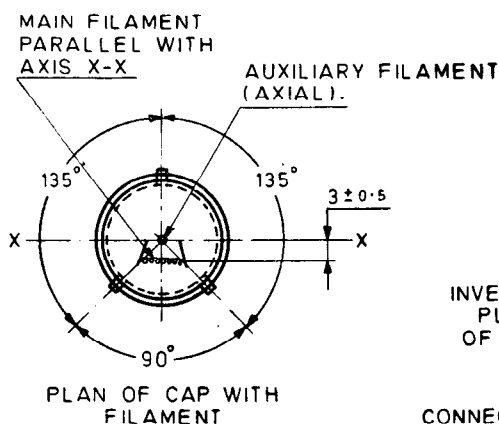
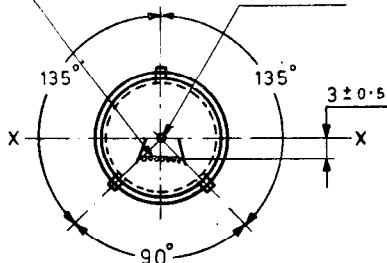
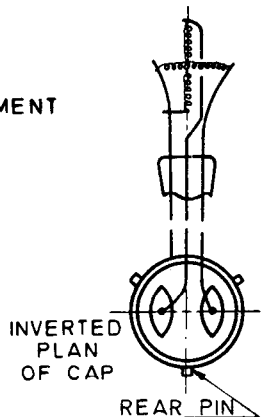
FIG. 1 OVERALL DIMENSIONS OF SHORT BOW FILAMENT
FOR LAMPS SL 13 AND 16



ELEVATION

INVERTED
PLAN
OF CAP

REAR PIN

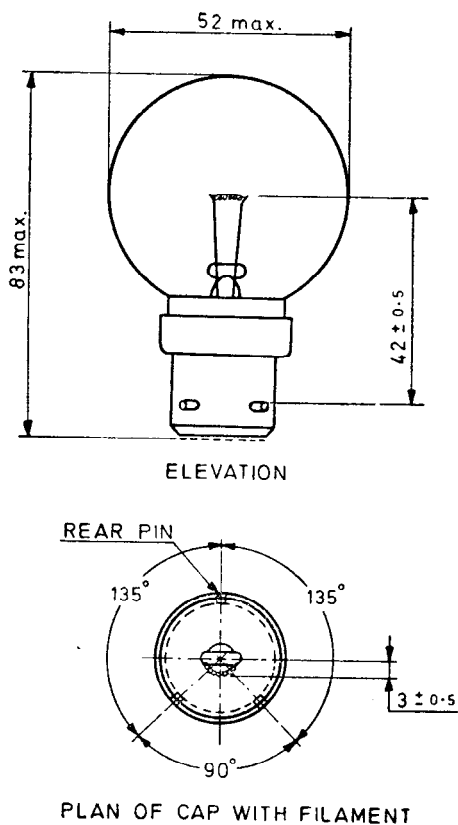
CONNECTIONS FOR DOUBLE
POLE LAMPS
SL 17 AND 21MAIN FILAMENT
PARALLEL WITH
AXIS X-XAUXILIARY FILAMENT
(AXIAL).PLAN OF CAP WITH
FILAMENTINVERTED
PLAN
OF CAP

REAR PIN

CONNECTIONS FOR TRIPLE
POLE LAMP SL 35

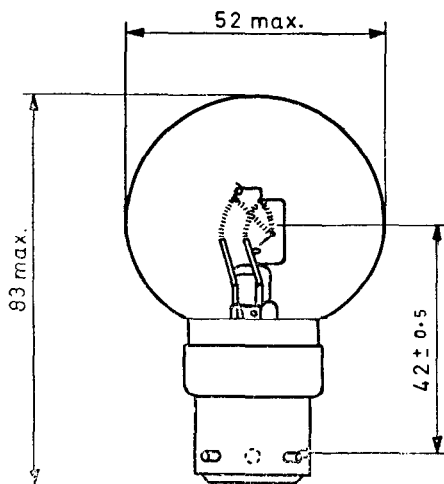
All dimensions in millimetres.

FIG. 2 DOUBLE FILAMENT LAMPS WITH B22/25 × 26 (3 PIN) CAPS



All dimensions in millimetres.

FIG. 3 SINGLE FILAMENT LAMP SL 18 WITH B22d/25 x 26 (3 PIN) CAP



All dimensions in millimetres.

FIG. 4 SINGLE FILAMENT LAMPS S 33

4.2 Inspection Test Quantity (ITQ) — The Inspection Test Quantity shall be five per cent of the batch* with a minimum of 35 and a maximum of 70 lamps.

4.3 Rating Test Quantity (RTQ) — The Rating Test Quantity shall be five-sevenths of the ITQ* selected at random from the lamps of the ITQ which have passed the inspection test.

4.4 Life Test Quantity (LTQ) — The Life Test Quantity shall be half of the RTQ* selected at random from the lamps of the RTQ which have passed the rating test.

5. MARKING

5.1 The lamps shall be distinctly and indelibly marked with the following information:

- Reference number (see Table 1),
- Rated voltage,
- Rated wattage,
- Manufacturer's name or trade-mark, and
- Name and year of manufacture.

NOTE — The information given in (c) may alternatively be marked on the carton if agreed between the purchaser and the supplier.

*If a fraction results from the calculation, the next higher whole number shall be taken.

TABLE 3 INITIAL READINGS AND LIFE REQUIREMENTS

(Clauses 3.2.1, 3.3.1, 7.4.1.1, 7.4.2.1 and 7.4.3.1)

REFER- ENCE NUMBER	LAMP RATED VOLTAGE	LAMP RATED WATTAGE			INITIAL READINGS			LIFE TEST VOLTAGE		SPECIFIED LIFE HOURS	
		Total	For Pole	Triple Lamps	Mini- mum Wat- tage	Maxi- mum Wat- tage	Mini- mum Lumens	Main Fila- ment	Auxi- liary Fila- ment	Main Fila- ment	Auxi- liary Fila- ment
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	V	W	W	W	W	W		V	V		
SL 5	12	4	—	—	—	4.4	21	15	—	100	—
SL 13	6	12	—	—	11.0	13.0	108	6	—	1 000	—
SL 16	12	12	—	—	11.0	13.0	101	12	—	1 000	—
SL 17	12	25	—	—	23.0	27.1	142	12	16	1 000	800
SL 18	12	24	—	—	22.0	26.0	260	12	—	1 000	—
SL 21	12	33	—	—	30.5	35.7	218	12	16	1 000	800
SL 33	110	25	—	—	22.5	27.1	122	110	—	1 000	—
SL 35	12	—	24	—	22.0	26.0	260	12	—	1 000	—
		—	—	24	22.0	26.0	260	—	12	1 000	1 000

5.2 The lamps may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

6. TESTS

6.1 Conditions of Tests

6.1.1 Position of Burning — For photometric and electrical measurements, the lamps shall be operated in the vertical position, cap up. For the ageing and life tests, the lamps shall be operated in the position for which they are designed to be used, as given in Table 2.

6.2 Mechanical, Physical and Marking Requirements

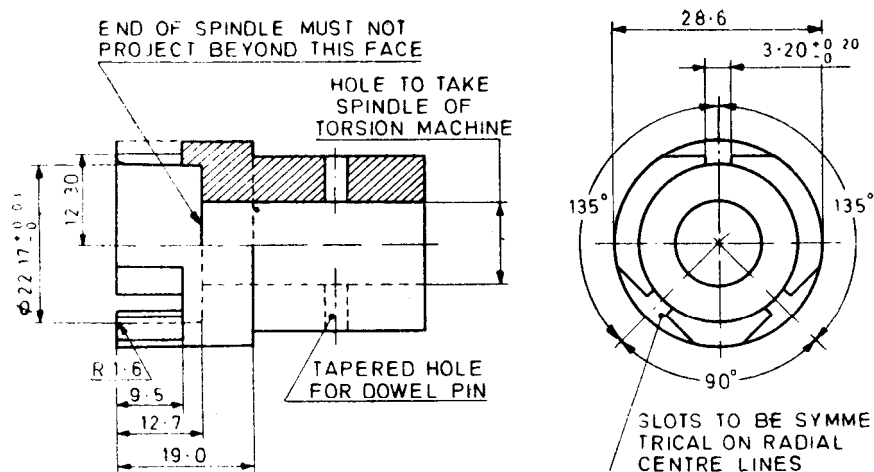
6.2.1 Each lamp of ITQ shall be examined visually as well as checked for all the requirements as given in 3.1 and 5.1.

6.2.1.1 Before putting up the lamps for inspection, the manufacturer shall check all lamps for the correct position of the filaments by lighting them in a suitable jig having a minimum magnification of 10.

6.2.2 Torsion Test — The lamps shall be inserted in special holders having dimensions given in Fig. 5 and 6, and fixed to a suitable torsion testing machine. The test shall then be carried out by twisting the bulbs. The torque shall not be applied suddenly but increased gradually to a torsional moment of 30 kg-cm in the case of B22 (3-pin or 2-pin) caps and 12 kg-cm in the case of B15 caps. The test shall be carried out both during Inspection Test and at the end of Life Test. At the end of the test, the bulbs shall be visually examined in respect of their attachment to caps.

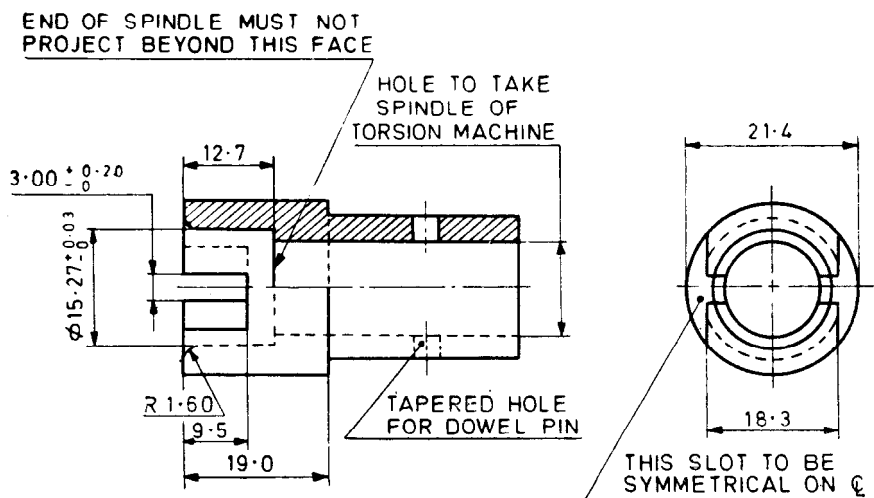
6.2.3 Insulation — The insulation resistance test shall be carried out immediately after the ageing of the lamp to ensure proper drying and the measurements shall be made one minute after the application of dc voltage of 500 V. The insulation resistance between the contact plates and the shell of the cap shall not be less than the values given in 3.1.3.

In case the insulation, when first measured, is found to be insufficient, the lamps shall be stored in warm dry atmosphere for a week and then retested for insulation.



To be case hardened. Dimensions to be within ± 0.3 mm unless otherwise stated.
All dimensions in millimetres.

FIG. 5 HOLDER FOR TORSION TEST FOR B22 (3 PIN) CAPS



To be case hardened. Dimensions to be within ± 0.3 mm unless otherwise stated.
All dimensions in millimetres.

FIG. 6 HOLDER FOR TORSION TEST FOR B15 CAPS

6.3 Initial Readings — Measurements for initial readings shall be made at the rated voltage. The photometric integrator for photometric measurements shall conform to IS : 2407-1973*. The voltmeter and ammeter used in the tests shall be of an accuracy class equivalent to at least 0.5 (see IS : 1248-1968†).

6.4 Life and Lumen Maintenance

6.4.1 Supply — The lamps shall be tested on ac supply at a nominal frequency of 50 Hz.

6.4.2 Test Voltage — The test voltage shall be a stable voltage (see 6.4.3) between 100 percent and approximately 110 percent of the rated voltage, the value to be selected by mutual agreement.

The equivalent life for rated volts shall be determined in accordance with the following equation:

$$L_o = L \left(\frac{U}{U_o} \right)^n$$

where

L_o = life at rated voltage,

L = life at test voltage,

U_o = rated voltage,

U = average effective voltage during life test, and

n = 13 for vacuum lamps and 14 for gas-filled lamps.

The lamps shall be burned on alternating current at a frequency of a nominal value between 40 Hz and 60 Hz.

NOTE — In general, testing at voltages in excess of the rated voltage is practised mainly for reasons of economy.

6.4.3 Voltage Control — The momentary fluctuation of the test voltage during the life test shall not exceed ± 1 percent, and the mean effective value of the test voltage during the life test shall be taken for the calculations given in 6.4.2. The voltage shall be free from perceptible flicker.

NOTE — Mean effective value of the voltage shall be obtained by a suitable V_m meter (see Appendix C).

6.4.4 Switching 'ON' and 'OFF' — Lamps shall be switched 'OFF' twice daily for periods of not less than 15 minutes, such periods not being considered as part of the burning hours of the lamp.

*Specification for photometric integrators.

†Specification for direct acting electrical indicating instruments (first revision).

6.4.5 Lumen Maintenance — Each lamp of the LTQ shall be tested for lumens at the rated voltage at 75 ± 2.5 percent of specified life. The lumen maintenance shall not be less than the value specified in 3.3.2. If it is less than the value specified, the lamp shall have a life of 69 percent of the rated life assigned to it.

6.4.6 Duration of Life Test — The life test shall be terminated at 125 percent of the rated life. A lamp still operating at 125 percent of the rated life shall have a life of 125 percent of the rated life assigned to it.

6.4.7 Accidentally Broken Lamps — Lamps which are accidentally broken before the completion of the life test shall when necessary be replaced to ensure that the required minimum number of lamps complete the test. No such broken lamps shall be included in calculating the results.

NOTE — In order to avoid unnecessary delay, it is recommended that spare lamps are carried through the tests.

7. CONDITIONS OF COMPLIANCE

7.1 A batch shall be considered as satisfying the requirements of this specification if the requirements contained in 7.2, 7.3 and 7.4 are satisfied. If the batch fails to satisfy the requirements of any of these clauses, it will be deemed as not complying with the specification and no subsequent tests shall be carried out from that batch.

7.2 Mechanical, Physical and Marking Requirements — A batch shall be deemed to comply with the requirements of 3.1 and 5.1, if the number of lamps failing does not exceed the qualifying limit given below:

<i>Test Quantity</i>	<i>Qualifying Limit</i>
a) For any single requirement	
35-54	3
55-70	4
b) For all requirements taken together	
35-44	5
45-56	6
57-70	7

7.3 Initial Readings — A batch shall be deemed to comply with the requirements of 3.2, if the number of lamps failing does not exceed the qualifying limit given below:

<i>Test Quantity</i>	<i>Qualifying Limit</i>
a) For initial wattage of individual lamps	
25-31	5
32-40	6
41-50	7

<i>Test Quantity</i>	<i>Qualifying Limit</i>
b) For initial lumens of individual lamps	
25-31	5
32-40	6
41-50	7
c) For initial wattage and initial lumens of individual lamps taken together	
25-28	6
29-34	7
35-41	8
42-48	9
49-60	10

NOTE — A lamp which is outside the requirements for both lumens and watt shall be counted as one outfall only.

7.4 Life Test — Lumen Maintenance and Life Requirements

7.4.1 Single Filament Lamps

7.4.1.1 The average life of the filaments of the lamps in the LTQ shall not fall below the value for specified life given in Table 3 by more than the allowance shown in Table 4.

7.4.1.2 The total number of lamps in LTQ in which the filament has a life shorter than 60 percent of the specified life given in Table 3 plus the number of lamps whose lumen maintenance is lower than the minimum specified in 3.3.2 plus failure due to explosion or implosion of the bulb shall not exceed the qualifying limit shown in Table 5.

7.4.2 Double Pole Lamps

7.4.2.1 The average life of the main filaments of the lamps in the LTQ shall not fall below the value for specified life given in Table 3 by more than the allowance shown in Table 4.

7.4.2.2 The total number of lamps in LTQ in which the number of lamps in which the main filament has a life shorter than 60 percent of the specified life given in Table 3 plus the number of lamps whose lumen maintenance are lower than the minimum specified in 3.3.2 plus failures due to explosion or implosion of the bulb during life test and auxiliary filament failures prior to main filament failure, shall not exceed the qualifying limit shown in Table 5.

7.4.2.3 The life test of the auxiliary filaments of SL 17 and SL 21 lamps shall be conducted as a type test. A minimum of ten lamps shall be tested for this purpose once a year, or earlier if desired by the purchaser

or his nominee. The average life of the auxiliary filaments of the lamps shall not be less than 800 hours at 16 V. The life test shall be terminated at 1 250 hours. A filament still operating at 1 250 hours shall have a life of 1 250 hours assigned to it.

7.4.3 Triple Pole Lamps

7.4.3.1 The average life of the main filament, and the average life of the auxiliary filaments, of the lamps in the LTQ shall not fall below the appropriate value for specified life given in Table 3 by more than the allowance shown in Table 4.

7.4.3.2 The total number of lamps in LTQ in which the main filament has a life shorter than 60 percent of the specified life given in Table 3 plus the number of lamps whose lumen maintenance for main filament is lower than the minimum specified in 3.3.2 plus failures due to explosion or implosion of the bulb during life test shall not exceed the qualifying limit shown in Table 5.

7.4.3.3 The total number of lamps in LTQ in which the auxiliary filament has a life shorter than 60 percent of the specified life given in Table 3 plus the number of lamps whose lumen maintenance for auxiliary filament is lower than the minimum specified in 3.3.2 plus failures due to explosion or implosion of the bulb during life test shall not exceed the qualifying limit shown in Table 5.

TABLE 4 ALLOWANCE ON SPECIFIED LIFE

(Clauses 7.4.1.1, 7.4.2.1 and 7.4.3.1)

TEST QUANTITY	ALLOWANCE PERCENT
13-14	15
15-16	14
17-19	13
20-22	12
23-25	11

TABLE 5 QUALIFYING LIMITS FOR LIFE TEST QUANTITY

(Clauses 7.4.1.2, 7.4.2.2, 7.4.3.2 and 7.4.3.3)

TEST QUANTITY	QUALIFYING LIMIT
13-15	3
16-23	4
24-25	5

APPENDIX A

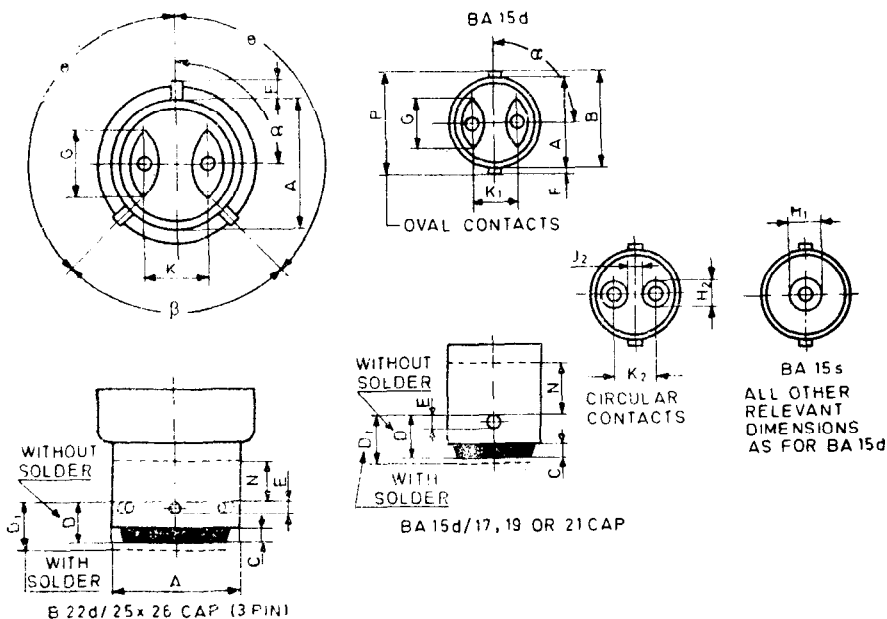
(Clause 3.1.2)

BAYONET LAMP-CAPS

A-1. Bayonet lamp-caps shall be as illustrated in Fig. 7 and shall have the dimensions shown in Table 6.

A-2. For finished lamps provided with only B22d/25×26 caps, creepage distance over insulation shall be not less than 3.0 mm between live parts and not less than 2.5 mm between live parts and the metal shell.

A-3. Caps shall be made with a flare, the diameter of which shall not be more than 1 mm greater than the maximum permissible diameter of the corresponding caps without a flare.



NOTE D = without solder, D_1 = with solder.

All dimensions in millimetres.

FIG. 7 BAYONET LAMP CAPS

TABLE 6 DIMENSIONS OF BAYONET LAMP-CAPS

(Clauses 3.1.2 and A-1)

All dimensions in millimetres.

REFERENCE LETTER	B22d/25 × 26		BA15d/17, 19 or 21		BA15s/17, 19 or 21	
	Max	Min	Max	Min	Max	Min
(1)	(2)	(3)	(4)	(5)	(6)	(7)
A	22.15	21.75	15.25	15.05	15.25	15.05
C*	—	1.5	—	1.5	—	1.5
D*	7	6	7	6	7	6
D1	8.0	—	7.5	—	7.5	—
E	2.2	1.8	2.2	1.8	2.2	1.8
F	2.7	2.3	—	0.64	—	0.64
G	—	10	—	9.0	—	9.0
H	—	—	—	(Approx)	5.2	(Approx)
J	—	4.0	—	—	—	—
K*	11.3	10.0	8.0	7.0	—	—
L*	26.45	25.95	—	—	—	—
M*	26.0	55.0	{ 17.75 19.25 21.25	{ 17.25 18.75 20.75	{ 17.75 19.25 21.25	{ 17.25 18.75 20.75
N†	—	6.7	—	8.9‡	—	8.9
P	—	—	5.2	—	—	—

*These dimensions are solely for cap design and should not be gauged on the finished lamp.

†N denotes minimum length of straight barrel for interchangeability.

‡For BA15d/17 and BA15s/ 17 caps, N = 7.0 Min.

APPENDIX B*(Clause 4.1)***STATISTICAL BASIS OF THE TEST QUANTITIES
AND THE CONDITIONS OF COMPLIANCE**

It is generally impracticable or uneconomic to test every lamp in a batch, but by use of statistical sampling theory it is possible to judge from tests on small quantities whether the quality of a submitted batch is likely to comply with the standard.

Accordingly, test quantities and quality levels have been specified. These have been associated with statistically determined qualifying limits. A batch is deemed to comply with the standard if the number of lamps outside the specified quality levels is not greater than the appropriate qualifying limit.

Lamps falling outside the specified quality levels are not necessarily failures or faulty lamps, but their numbers serve to determine the level of quality.

The qualifying limits are such that there is at least a 0.975 (39/40ths) probability of compliance when the luckbulk of the manufacturer's production contains:

- a) not more than 2 percent failing any single requirement and not more than 5 percent failing the clauses combined;
- b) not more than 7 percent outside the requirements for initial readings when each requirement is taken separately and not more than 10 percent when they are combined; and
- c) not more than 7 percent failing the individual life requirements.

APPENDIX C

(Clause 6.4.3)

BRIEF DESCRIPTION OF V^2 METER

C-1 The V^2 meters are based on the same principle as the normal single phase induction kilowatt hour meters. The difference is that a fine-wired coil in series with a high resistance has been substituted for the normal current coil. This coil as well as the normal voltage coil are both connected in parallel to the mains.

C-2. As the speed of the rotation of the disc is proportional to the voltage on the voltage coil and the current in the current coil, and as the latter is proportional to the voltage, with the built-in resistance constant, the speed of rotation of the disc is proportional to the square of the voltage. Hence, the reading per unit of time is proportional to the square of the voltage.

The measurement of the time is done by a clock-work starting and stopping with voltage on and off. If the clock-work is of the synchronous type, it should be ensured that the frequency is correct. If it is of the electrically worked self-starting type with a balance, it should be compared with a normal good watch adjusted in the normal way.

C-3. The accuracy of the V^2 meter depends on the steadiness of the voltage used. The accuracy is generally about 0.25 percent when the voltage used is within ± 1 percent. In this respect, the V^2 meter is more accurate than any recording voltmeter the accuracy of which is mostly not greater than 2 percent of the full-scale value.

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